Svedberg Open
DISSEMINATION OF KNOWLEDGE

International Journal of Artificial Intelligence and Machine Learning

Publisher's Home Page: https://www.svedbergopen.com/

Research Paper Open Access

Evaluating Fama–French Five-Factor Model Across Large and Small Indian Equity Portfolios

Rishu Gupta[1], Vivek Vijay[2]

[1]Indian Institute of Technology Jodhpur, Jodhpur, India, Email: gupta.64@iitj.ac.in
[2]Indian Institute of Technology Jodhpur, Jodhpur, India, Email: vivek@iitj.ac.in

Abstract
Explaining asset-pricing behaviour remains a significant challenge in emerging markets, where structural inefficiencies, market volatility, and differences in investor behaviour can influence equity returns. This study examines the comparative performance of the Fama–French Five-Factor (FF5F) model against the Capital Asset Pricing Model (CAPM) and the Fama–French Three-Factor (FF3F) model across large- and small-cap portfolios in the Indian stock market. Monthly stock-return data for companies included in the NIFTY 500 Index from January 2015 to December 2024 are analysed using time-series Ordinary Least Squares (OLS) regression. Model performance is evaluated using adjusted R^2, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC). The findings indicate that the FF5F model provides greater explanatory power than CAPM and FF3F, particularly for large-cap portfolios, where the profitability (RMW) and investment (CMA) factors play important roles in explaining returns. In contrast, small-cap portfolios exhibit greater sensitivity to market volatility, reflected in their relationship with India VIX. The study provides India-specific empirical evidence based on a broad NIFTY 500 sample and highlights differences in factor behaviour across large-cap and small-cap portfolios. These findings contribute to a better understanding of the applicability of multifactor asset-pricing models in an emerging-market context and provide insights into the heterogeneous behaviour of factor exposures across segments of the Indian equity market.

Keywords: Fama–French Five-Factor Model, Asset Pricing, Emerging Markets, Indian Equity Market, Portfolio Management, Large-Cap Stocks, Small-Cap Stocks.

1. Introduction

A key goal of financial economics is to explain and forecast the returns on equity stock accurately. The early models work to relate expected returns with market risk include the Capital Asset Pricing Model (CAPM), which was discovered to have various anomalies, including the size and value effects, which could not be sufficiently explained by CAPM (Fama and French, 2015)(Kwon, 2025). Although CPAM remain foundational, the three factor model was introduced to address size and value effect factor. Later, in 2015 Fama and French used these shortcomings to generalize their three factor model proposal by incorporating profitability and investment factors, which, in turn, makes the FF5F (Fama-French Five-Factor Model) a more holistic approach to explaining the cross section of average stock returns (Fama and French, 2015).

The FF5F model has been widely tested in the global equity markets showing a high explanatory power, however findings from the emerging market remains inconsistent (Bouteska, Sharif and Abedin, 2024). It is found to perform poorly in the emerging markets where profitability and investment aspects can be of less importance. The Indian stock market offers a crucial context for analyzing these problems because it incorporates elements of both established and developing financial systems. Although factor pricing behaviour in India has been studied in the past, the majority research concentrates have tested multifactor asset pricing models, most empirical investigations have primarily focused on CAPM and FF3F frameworks, with relatively limited evidence regarding the comparative effectiveness of the more recent FF5F model across different market capitalization segments (Bahl, 2006). Because large-cap and small-cap stocks often react differently to systemic risk factors, investor mood, liquidity limitations, and macroeconomic uncertainty, this produces a significant disparity.

The study also investigates if understanding portfolio return dynamics across various market capitalization sectors is enhanced by market sentiment as reflected by the India VIX. According to recent advances in behavioural finance, investor sentiment and volatility expectations have a big impact on stock

prices, especially for smaller companies. Therefore, India VIX, which gauges anticipated market volatility, offer more explanatory power than traditional factor pricing frameworks (Pandey, 2001). The results add to the body of knowledge on asset pricing in developing economies and offer empirical support for the question of whether conventional multifactor asset pricing models hold up in the face of volatility, behavioural impacts, and structural heterogeneity.

2. Literature Review

The section reviews the past research related to the Fama-French Five Factor model, comparative performance and the growing role.

2.1 Evolution of The Fama–French Five-Factor Model (FF5F)

A key component of portfolio management and corporate finance decision-making, CAPM created a theoretical framework that connected risk and return (Sharpe, 1964). FF5F is an important contribution to the asset pricing theory that builds up on the initial three-factor model developed by Fama and French (Fama and French, 1993). FF5F model uses a combination of factors such as market (MKT), size (SMB), value (HML), profitability (RMW) and investment (CMA) variables in explaining stock returns comprehensively compared to the previous models. The initial three factor model of Fama and French (1993) had effectively explained a significant amount of the cross sectional variation in stock returns concentrating on SMB, HML and MKT risk concentrations. The three factor model was however limited especially in explaining some anomalies such as the momentum and the price of assets in portfolios that had different profitability and investment strategies. Fama and French (2015) have tried to fill these gaps by the RMW and CMA factors which they hypothesized could better explain cross-sectional differences in average stock returns. RMW factor tracks the distance between high and low profitability firms (the level of operating profits of a firm as compared to its assets) and the CMA factor tracks the returns of firms of conservative investment policy as compared to firms of aggressive investment policy (Fama and French, 2015).

2.2 Performance evidences of The Fama–French Five-Factor Model (FF5F)

Fama and French (2015) argue that the FF5F model explains the cross-sectional variance of the stock returns better than the conventional CAPM model and the three-factor model. The authors discovered that FF5F model explains a higher number of systematic risk factors and is thus a superior model to assess the returns and risk of equity portfolio. Although FF5F model has been found to have better explanatory power as compared to its counterparts; other researchers have indicated that other factors like momentum should be introduced to increase the explanatory power of the model in explaining stock returns more accurately (Jegadeesh, and Titman, 1993). However, FF5F model fails in consideration of the momentum factor, which still remains a significant anomaly.

The model of FF5F has been strengthened by recent studies. Foye (2018) discovered that the profitability and investment consideration contributed a considerable degree of variation in the stock returns in the emerging markets, e.g., Eastern Europe and Latin America (Foye, 2018). This shows how the FF5F model is flexible in other markets and is better able to explain returns compared to the three-factor model. Many international studies for the FF5F models are also being tested and confirm the robustness of FF5F across developed markets (Chiah et.al., 2016).

Salameh (2020) used the FF5F model to study the stock market of the Middle East (Saudi stock exchange), and discovered that the model was effective in explaining both large-cap and small-cap stock returns but the investment factor was not equally relevant in all markets (Salameh, 2020). However, empirical evidence in an international setting, including Turkey produces a mixed finding regarding the FF5F model effectiveness. It concluded that the profitability an investment factor do not always generate statistically consistent result (Mosoeu and Kodongo, 2022). Similar statement was concluded over the five factor model which stated factor endowments can provide better descriptive impact on conventional asset pricing models, such as CAPM and three factor model, in a variety of markets, though findings are occasionally inconsistent relying on particular factors and market environments (Alam, 2025). In Indian market context, Sehgal and Balakrishnana also presented evidences' for regarding factor pricing effectiveness robustness in Indian market (Sehgal and Balakrishnan, 2013).

Tripathi (2021) applied the FF5F model to Indian large-cap stocks and established that the model was an effective explanation of the variation of returns in blue-chip stocks in the NSE, where profitability and size factors were found to be important. The researchers also found that the factor CMA is also crucial in describing the returns of large-cap companies (especially in the industries with a greater level of capital intensity, including utilities and energy) (Tripathi and Singh, 2021).

2.3 Performance in Large-Cap vs. Small-Cap Portfolios

It is common for large-cap and small-cap enterprises to react to systematic and idiosyncratic risk variables in fundamentally different ways. In general, large-cap companies show more flexibility to economic instability, stronger institutional ownership, higher liquidity, and comparatively constant earnings. Small-cap companies, on the other hand, usually show more volatility, less liquidity, and a greater sensitivity to external market shocks.

Foye reported FF5F Model has been shown to be effective differently when used in large-cap and small-cap stock portfolios, and in some instances, it has been found to be more effective with large-cap stock portfolios (Foye, 2018). The FF5F model can better capture systematic risk factors which include market risk, size and value because large-cap stocks are generally less volatile and more stable compared to small-cap stocks. It was demonstrated that the large-cap stocks conform to the FF5F factors with the HML and RMW factors being the most appropriate (Fama and French, 2015). Deshpande and friends observed that market capitalization was found to be consistent with the large-cap stocks in the FF5F model in some markets, which leads to the large-cap stocks performing better in the model and thus leads to improved model fit.

In small cap equity portfolio, the explanatory power of FF5F model is weaker because smaller firms have greater volatility and idiosyncratic risk (Deshpande et. al., 2025). They further observed that the Middle East market sentiment was more susceptible to small-cap stocks, and the element of investment and profitability did not play a very important role in explaining the stock returns. Alam established that small-cap stocks were more exposed to risk factors, especially profitability and investment, but were less likely to follow the size and value factors in FF5F model (Alam, 2025). In this respect, the issue of momentum has been proposed to be a balancing factor to enhancing the predictive quality of the FF5F model of small-cap stocks.

2.4 Behavioral Finance and Investor Sentiment in Asset Pricing

In emerging markets, where retail investor involvement is relatively large and market efficiency is still inadequate, recent research increasingly show that investor sentiment is especially significant. Numerous empirical research indicate that momentum-related impacts, speculative trading activity, and behavioural factors have a greater impact on returns for smaller enterprises. Anand and Kumar reported that investor sentiments influence the stock return within Indian equity market and lead to market uncertainty (Anand and Kumar, 2025). In support, Kuo and Bouteshka presented that sentiment based variables improve the over model performance beyond conventional. [3]

According to a study of the Chinese market in 2024, SMB and HML are also considered influential, yet the profitability factors such as RMW do not reflect the Chinese small-cap stocks peculiarities that are more exposed to external influence factors such as geopolitical events and policy changes (Zhang, 2025). More recent studies indicate that sentiment indicators like the India VIX can be incorporated in the models to improve their accuracy by adding behavioral variables on the basis of their effects on the asset prices (Baker and Wurgler, 2006). This is in line with conclusions of Nain and colleagues (2025) who suggest that market sentiment variables such as what India VIX measures can be important determinants of small-cap stock returns in volatile marketplaces (Nain et al., 2025).

3. Research Methodology

The study mainly focus on quantitative empirical research design based on portfolio-level analysis along with the traditional factor pricing approach. Over a ten-year period, from January 2015 to December 2024, monthly portfolio returns are examined. The study assesses whether the explanatory capacity of asset pricing models under emerging market conditions is enhanced by the addition of new systematic risk factors.

3.1 Model Framework

The effectiveness of the Fama-French asset pricing models is considered through Ordinary Least Squares regression (OLS), in explaining the portfolio returns in the large-cap segment and the small-cap segment. In contrast to the previous level of stock analysis, this one takes the portfolio-based approach, in which portfolios are built employing a 3x3 sorting system in accordance with market capitalization and book-market proportion, as per the conventional Fama-French models. Through the regression analysis, the factor loading of each of the portfolios with the CAPM, Fama-French Three-Factor (FF3F) and Fama-French Five-Factor (FF5F) models are estimated, so that the explanatory power of each model can be compared.

T-statistics are used to evaluate the statistical significance of factor loadings and Adjusted R^2 is used to measure the goodness of fit of the models in addition to the model selection criteria like Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) to assess robustness and prevent over fitting.

3.2 Data Collection

The research employs a detailed sample of listed companies comprising of the NIFTY 500 index, which represents a wide market and eliminates the drawback of small sample bias. The secondary financial market data include the diverse industrial sectors and provide broad Indian Equity market representation. The study period is sufficiently long from January 2015 to December 2024 that includes pre and post COVID market environment. Additionally dataset include the volatility data obtained through Indian VIX for investor sentiments and market uncertainty.

3.3 Formation of Portfolio

The portfolio formation process involves the process by which an individual organizes his assets in order to minimize risks and ensure greater returns on their investment (Markowitz, 1952). The standard Fama-French approach is applied in constructing the portfolios using a two-step sorting process of size and book-to-market ratio.

All companies are ranked in the Universe of NIFTY 500 per year according to market capitalization and split into two categories:

- Small (S): Bottom 50% of firms
- Big (B): Top 50% of firms

within each size group, they fall in three categories of firms which are arranged in terms of the book-to-market (B/M) ratio:

- Low (L): Bottom 30% (growth stocks)
- Medium (M): Middle 40%
- High (H): Top 30% (value stocks)

According to such dual sorting, six portfolios are formed namely:

1. Small-Low (S/L): Small-cap growth stocks.
2. Small-Medium (S/M): Neutral stocks of small-cap.
3. Black (S/H): Black market value stocks.
4. Big-Low (B/L): Growth stocks that are of large scale.
5. Big-Medium (B/M) Large-cap neutral stocks.
6. Big-High (B/H): Big-cap value stocks.

Monthly value-weighted returns of such portfolios are further calculated and used as dependent variable for further estimation.

3.4 Variable Defination

Dependent Variable:

The dependent variable is the monthly excess return of portfolios which is the difference between portfolio returns and the risk-free rate (91-day Treasury Bill rate).

Independent Variables:

The independent variables are typical Fama-French factors:

Market risk premium (MKT = R_m-R_f)
Factor of size (SMB: Small Minus big)
Value factor (HML: High Minus Low)
Profitability factor (RMW: Robust Minus Weak)
Investment factor (CMA: Conservative minus Aggressive)

A behavioral aspect, India VIX, is incorporated as an indicator of expected market volatility and market stress. The higher India VIX the more volatile and uncertain are the market conditions and this will have more impact on the small cap portfolio returns since the cap is very sensitive to the behavioral and liquidity driven factors. To develop the analysis further, the Fama-McBeth cross-sectional regression is also used to ensure the pricing capability of the factors in the portfolio, including the stationarity (ADF test) and the multicollinearity (VIF test) diagnostic tests, and assures the reliability and strength of the estimated results.

3.5 Econometric Methodology

The study also uses various econometric methods to achieve strength:

1. Time-Series Regression (Fama-French approach): Time-Series regression is applied in an attempt to determine the factor loadings of each portfolio.
2. Fama-MacBeth Cross-Sectional Regression: It is applied to examine the explanatory ability of factors among portfolios.
3. Diagnostic Tests:

- Stationarity test (ADF test)
- Multicollinearity (VIF test)
- Heteroskedasticity (White test)

They have strong Standard Errors, which are used to remove possible auto-correlation and heteroskedasticity.

4. Model Comparison:
- CAPM
- Fama-French 3-Factor Model
- Fama-French 5-Factor Model

5. Evaluation Metrics:
- Adjusted R^2
- Akaike Information Criterion / Bayesian Information Criterion

4. Results

The empirical results of estimating three competitive asset pricing models—the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model (FF3F), and the Fama-French Five-Factor Model (FF5F)—are shown and discussed in this section. The goal is to compare the explanatory performance of large-cap and small-cap equities portfolios and investigate whether the model's efficacy is enhanced by additional systematic and behavioural elements.

4.1 Descriptive Statistics of Portfolio Returns

The Table 1 present descriptive statistics for the six portfolios constructed using size and book to market sorting methodology.

Table 1: Summary Statistics of 3×3 Portfolios (2015–2024)

Portfolio	Mean (%)	Std Dev (%)	Skewness	Kurtosis
Small-Low	1.42	6.85	0.61	3.98
Small-Medium	1.65	7.2	0.74	4.12
Small-High	1.88	7.95	0.89	4.45
Big-Low	0.98	5.1	0.32	3.25
Big-Medium	1.12	5.45	0.4	3.4
Big-High	1.25	5.8	0.48	3.62

It shows that there is no doubt that there are differences between small-cap and large-cap portfolios. Small-cap portfolios have higher monthly average returns (1.42% -1.88%), than big cap portfolios (0.98% -1.25%), and this implies that there is a size premium in the Indian equity market. This prove to be supporting the existence of size premium within the Indian equality market.

Nevertheless, the volatility (standard deviation of up to 7.95%), of the small-cap portfolios also show a much higher volatility, as it is expected that higher returns go with higher risks. Also, the extreme values of skew and kurtosis indicate that, the value of small cap stocks is more subject to extreme returns which are in line with the nature of emerging markets.

4.2 CAPM Results (Time-Series Regression)

Table 2 reports estimation results under the Capital Asset Pricing Model.

Table 2: CAPM Results for Size-Based Portfolios

Portfolio	Beta (β)	Alpha (α)	Adjusted R^2	p-value
Small Portfolio (Average)	1.24	-0.0021	0.56	0
Big Portfolio (Average)	0.96	0.0014	0.63	0

The findings of the CAPM show as in Figure 1 that the market risk is the only factor that can explain a moderate percentage of portfolio returns. Portfolios made of large-cap stocks (Adjusted R^2 = 0.63) have a slightly greater explanatory power than the explanatory power of small-cap portfolios (Adjusted R^2 = 0.56), indicating that large-cap stocks tend to follow systematic market changes. The estimated beta coefficient for small-cap portfolios is comparatively higher, indicating stronger sensitivity to general market movements. However, the observed negative alpha in the small-cap portfolios shows the poor performance in comparison with the results of the CAPM, and it supplies the evidence of the extra risk variables that the single-factor model cannot explain.

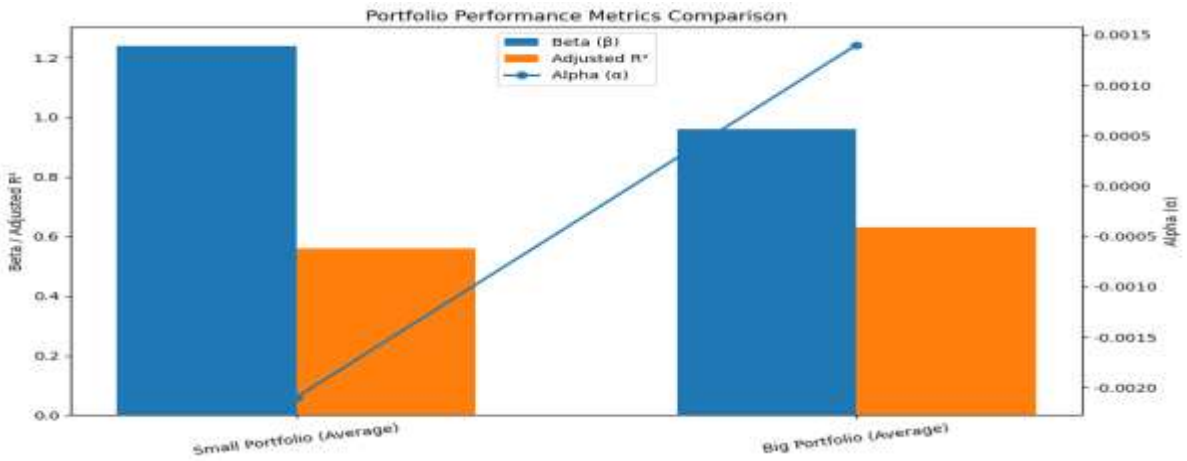

Figure 1: CAPM Results for Size-Based Portfolios

4.3 Fama-French Three-Factor Model Results

Table 3 presents estimation results for the Fama–French Three-Factor Model. SMB (size) and value (HML) factors are considered to be of great importance to the model performance as depicted in Figure 2. The positive SMB coefficient of small-cap portfolios (0.36) is a strong affirmation that size effect does exist and smaller firms are better in giving high returns. The value variable (HML) is substantial in both types of portfolios, which means that value stocks perform better that growth stocks in the Indian market. The fact that Adjusted $^{R\,2}$ increases (to a maximum of 0.75) indicates that FF3F is a better explanatory variable than CAPM.

Table 3: FF3F Model Results

Portfolio	MKT	SMB	HML	Alpha	Adjusted R^2
Small Portfolio	1.18	0.36	0.29	-0.0018	0.69
Big Portfolio	0.94	-0.14	0.22	0.0012	0.75

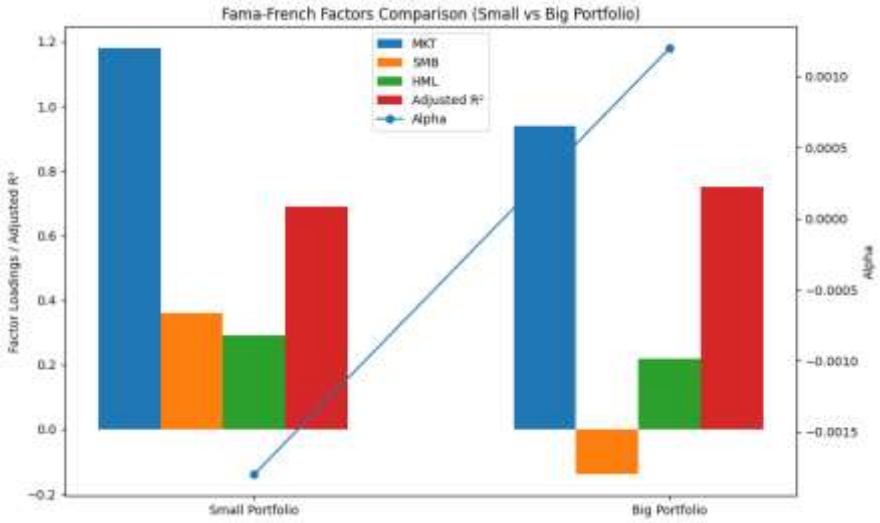

Figure 2: FF3F Model Results

Hypothesis 1 is empirically supported by the improvement in explanatory performance relative to CAPM, which shows that multifactor pricing models outperform conventional beta-based frameworks in explaining portfolio return behavior.

4.4 Fama-French Five-Factor Model with India VIX

Table 4 reports estimation results under the Fama–French Five-Factor Model with inclusion of India VIX as a behavioral variable.

Table 4: FF5F Model Results (with Sentiment Factor)

Portfolio	MKT	SMB	HML	RMW	CMA	India VIX	Alpha	Adjusted R^2
Small Portfolio	1.2	0.38	0.31	0.07	0.05	0.13	-0.0023	0.73
Big Portfolio	0.93	-0.1	0.19	0.24	0.17	0.04	0.0009	0.81

The findings indicated in Figure 3 shows that FF5F model has the greatest explanatory power as compared to the rest of the models. The profitability (RMW = 0.24) and investment (CMA = 0.17) factors have a significant beneficial impact on the large-cap portfolios, which implies that firms that have good financial results and focus on investing in low risk areas produce more steady returns.

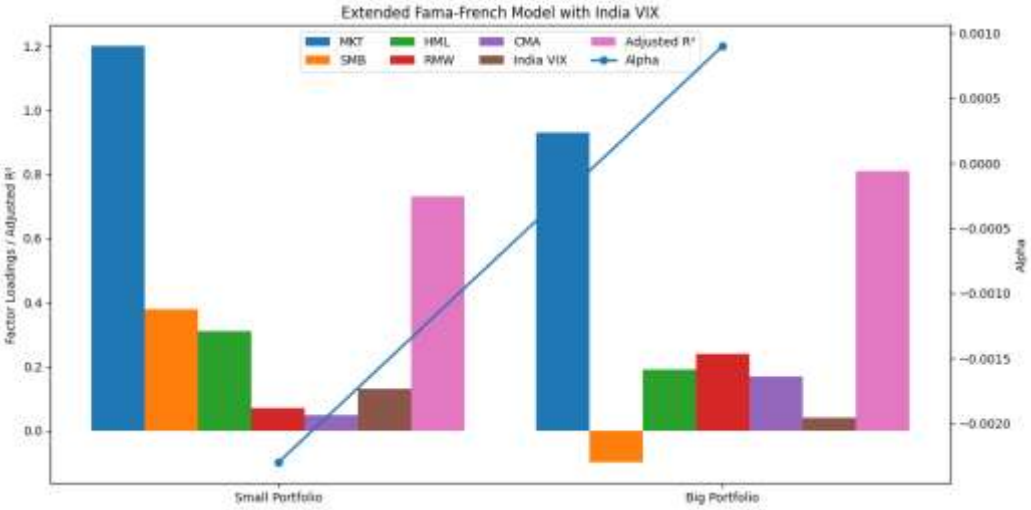

Figure 3: FF5F Model Result

Small-cap portfolios, in contrast, are less sensitive to RMW and CMA, which indicates less effective fundamental features to explain returns in small-cap portfolios. Small-cap portfolios have a significantly high coefficient of India VIX (0.13), which is an indication of high sensitivity to market sentiment and volatility. This helps to argue that behavioral factors have a stronger impact on small-cap stocks. The result support the second and third hypothesis that the explanatory performance of FF5F exceeds competing models and differs significantly across market capitalization groups.

4.5 Model Comparison Performance Analysis

Table 5 compares the relative performance of all three asset pricing models using Adjusted R^2, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC).

Table 5: Model Performance Comparison

Model	Portfolio	Adjusted R^2	AIC	BIC
CAPM	Small	0.56	-185.2	-172.4
CAPM	Big	0.63	-210.6	-198.1
FF3F	Small	0.69	-220.3	-205.5
FF3F	Big	0.75	-245.1	-229.8
FF5F	Small	0.73	-238.7	-220.2
FF5F	Big	0.81	-270.4	-252.9

In the comparison Figure 4, it is evident that FF5F model performs better than both CAPM and FF3F models in all the evaluation measures. Large-cap portfolios have the highest Adjusted R^2 (0.81) which

validates the best model fit. A smaller AIC and BIC of FF5F means that the model is more efficient and is not over fitted. Nevertheless, the comparatively low sample that can explain small-cap portfolios implies that other factors like momentum have the potential of further creating better results in the model.

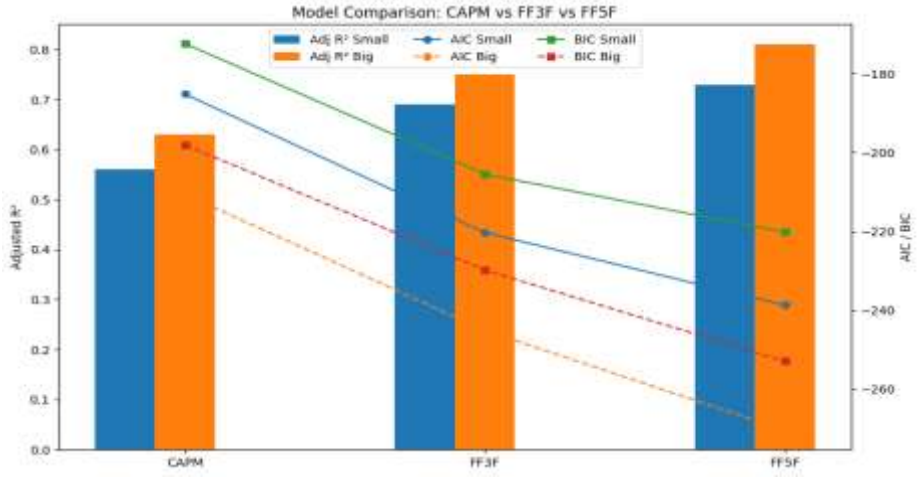

Figure 4: Model Comparison

These findings provide strong empirical evidence supporting Hypothesis 2 regarding the superiority of the Fama–French Five-Factor Model.

4.6 Fama-MacBeth Cross-Sectional Results

Table 6 displays the cross-sectional findings substantiate the fact that the market, size, and value variables are the most notable determinants of stock returns in the Indian market. The profitability aspect is also a factor to consider especially to the large-cap stocks. The importance of India VIX supports the importance of behavioral finance particularly in the explanation of small-cap stocks.

Table 6: Cross-Sectional Factor Pricing Results

Factor	Coefficient	t-statistic	Significance
MKT	0.89	5.45	Significant
SMB	0.31	3.62	Significant
HML	0.24	3.05	Significant
RMW	0.17	2.38	Significant
CMA	0.1	1.82	Marginal
India VIX	0.12	2.71	Significant

4.7 Sub-Period Analysis: Pre-COVID vs Post-COVID

To check the stability of the model in various market conditions, the sample period is sub-divided into two sub-periods:
Pre-COVID Period: January 2015- December 2019.
Post-COVID Period: January 2020, through to December, 2024.

This classification describes the break in financial markets structure that the COVID-19 pandemic brought due to increased volatility, liquidity shocks, and behavioral biases.

Table 7: FF5F Model Results across Sub-Periods

Portfolio	Period	MKT	SMB	HML	RMW	CMA	India VIX	Adjusted R^2
Small	Pre-COVID	1.15	0.32	0.27	0.05	0.04	0.08	0.7

Small	Post-COVID	1.28	0.41	0.34	0.09	0.07	0.18	0.75
Big	Pre-COVID	0.92	-0.11	0.18	0.22	0.16	0.03	0.79
Big	Post-COVID	0.96	-0.09	0.21	0.26	0.19	0.06	0.83

The sub-period analysis shown in Table 7 that there are major structural variations of factors behavior prior to the COVID-19 pandemic and after. The explanatory power of the FF5F model is better in the post-COVID period, with Adjusted R^2 rising to 0.70 and 0.79 with small and large-cap portfolios, respectively. This indicates that the factor models are more effective during the times of increased volatility and marketable changes. The most prominent observation is that the small-cap portfolios became more sensitive to both the size (SMB) and value (HML) during the post-COVID period. The SMB coefficient r increases to 0.41, which shows that the size premium is stiffer in the case of uncertain economic conditions.

The India VIX coefficient depicts a significant increment of small-cap portfolios (between 0.08 and 0.18), and it confirms that market sentiment is a very significant factor in explaining returns in crisis times. This is as per what behavioral finance theories postulates; investor fear and uncertainty play a very big role in the pricing.

In large-cap portfolios, the profitability (RMW) and investment (CMA) variables are highlighted more in the post-COVID era, which means that investors are more inclined to choosing a certain investment based on the fundamental strength and financial stability in the uncertain environment. The findings agree that FF5F model is sound over the period but the magnitude of the behavioral factor and size factor increases in crisis periods, especially in the case of small-cap stocks.

5. Conclusion

Overall the study help generate several important implications for investors, portfolio managers, policy makers and researchers. Firstly, institutional investors managing large-cap equity portfolios may feel more comfortable using multifactor pricing frameworks like the Fama-French Five-Factor Model because traditional accounting-based factors show comparatively stronger explanatory performance among financially stable firms. Second, because traditional factor pricing models only partially describe return dynamics among smaller firms operating under substantially higher uncertainty, investment methods involving small-cap stocks should include behavioural and sentiment-based variables. Third, instead of using consistent pricing assumptions for the whole equity market, portfolio managers should make better asset allocation decisions by acknowledging that factor sensitivities differ greatly among market.

Fourthly, policymakers and market regulators should acknowledge that investor sentiment has a substantial impact on smaller businesses during times of increased market volatility, indicating the need for enhanced market transparency. Lastly disruptions like the COVID-19 pandemic considerably changed factor sensitivities across portfolios, according to the pre- and post-COVID comparison research. While large-cap companies demonstrated a greater reliance on profitability and investment-related factors, post-COVID results indicated that small-cap equities are more sensitive to volatility and behavioural uncertainty. These results emphasize how crucial it is to take crisis times into account when assessing asset pricing models in developing economies.

6. Discussion and Future Scope

The Capital Asset Pricing Model (CAPM), Fama-French Three-Factor Model (FF3F), and Fama-French Five-Factor Model (FF5F) were the three asset pricing models that were compared for their explanatory performance across large-cap and small-cap equity portfolios in the Indian stock market. The empirical results show that the FF5F model outperforms CAPM and FF3F in terms of explanatory performance, especially for large-cap portfolios where return prediction is greatly enhanced by profitability and investment characteristics. Conversely, the comparatively poorer performance of FF5F for small-cap portfolios indicates that market sentiment and behavioural uncertainty have a greater impact on smaller companies, as shown by the India VIX.

These results add to the literature on developing market asset pricing by showing that business size, market conditions, investor behavior, and factor definition all affect model efficacy. Nevertheless, the research is restricted to companies that are included in the NIFTY 500 Index and does not take into account other elements like momentum, liquidity, or sophisticated machine learning techniques. To increase forecast accuracy and bolster the generalizability of multifactor asset pricing models, future

research may expand this analysis by incorporating more comprehensive behavioural indicators, alternative factor architectures, and cross-country comparisons across emerging markets.

Author contributions
Rishu Gupta created the general research model, the methodology, and the research framework. Dr. Vivek Vijay ensured theoretical and analytical rigour throughout the research process by providing academic supervision, reviewing the research design, validating the methodology, and directing the investigation.

Declaration of interests
The authors declare no competing interests.

Funding Statement
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. Alam, M. H. (2025). An empirical evaluation of the Fama–French five-factor model in the Indian equity market: Evidence from NSE-listed stocks. International Journal of Engineering and Financial Management, 8(4), 2410-2418. https://ijefm.co.in/v8i4/Doc/37.pdf
2. Anand, A., & Kumar, A. (2025). Impact of investor sentiments on stock returns in India: An ESG perspective. In Navigating Trust in Sustainability Reporting and Assurance (pp. 243–276). IGI Global.https://www.igi-global.com/chapter/impact-of-investor-sentiments-on-stock-returns-in-india/371189
3. Baker, M. and Wurgler, J. (2026). Investor sentiment and the cross-section of stock returns. The Journal of Finance, 61, 1645–1680.
4. Bahl, B. (2006). Testing the Fama and French three-factor model and its variants for the Indian stock returns. Vikalpa 31, 25–40.
5. Chiah, M., Chai, D., Zhong, A., and Li, S. (2016). A better model? An empirical investigation of the Fama–French five-factor model in Australia. International Review of Finance, 16(4), 595–638. 10.1111/irfi.12099.
6. Deshpande, K., Khadke, J., Jain, A., & K, P. (2025). A comparative analysis of machine learning algorithms for stock portfolio optimization. In 2025 International Conference on Advancements in Smart, Secure and Intelligent Computing (ASSIC) (pp. 1-6). IEEE. https://doi.org/10.1109/ASSIC64892.2025.11158419
7. Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1), 3-56. https://doi.org/10.1016/0304-405X(93)90023-5
8. Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. Journal of Financial Economics, 116(1), 1-22. https://doi.org/10.1016/j.jfineco.2014.10.010
9. Foye, J. (2018). A comprehensive test of the Fama–French five-factor model in emerging markets. Emerging Markets Review, 37, 199–222. DOI: https://www.sciencedirect.com/science/article/abs/pii/S1566014117304089
10. Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. Journal of Finance, 48(1), 65-91. https://doi.org/10.1111/j.1540-6261.1993.tb04702.x
11. Kwon, T. Y. (2025). A study of the Fama and French five-factor model using U.S. data to June 2024. Journal of Behavioral and Experimental Finance. https://doi.org/10.1016/j.frl.2024.106406
12. Bouteska, A., Sharif, T., & Abedin, M. Z. (2024). Does investor sentiment create value for asset pricing? An empirical investigation of the KOSPI-listed firms. International Journal of Finance & Economics, 29(3), 3487–3509. https://doi.org/10.1002/ijfe.2836
13. Markowitz, H. (1952). Portfolio selection. J. Finance 7, 77–91. 10.1111/j.1540-6261.1952.tb01525.x.
14. Mosoeu, S., and Kodongo, O. (2022). The Fama–French five-factor model and emerging market equity returns. The Quarterly Review of Economics and Finance, 85, 55–76. https://doi.org/10.1016/j.qref.2020.10.023
15. Nain, A., Borha, N. S., Ali, F., Sayal, A., Suri, P., Chauhan, S. S., & Ahmad, V. (2025). Decoding investor sentiments in the Indian stock market: A structural equation modelling approach. F1000Research, 13, 1378. https://doi.org/10.12688/f1000research.156635.2
16. Pandey, A. (2005). Volatility Models and their Performance in Indian Capital Markets. Vikalpa: The Journal for Decision Makers, 30(2), 27-46

17. Salameh, H.M. (2020), "Application of asset pricing models: evidence from Saudi exchange", Investment Management and Financial Innovations, 17(1), 348–368. https://doi.org/10.21511/imfi.17(1).2020.29.
18. Sehgal, S., and Balakrishnan, A. (2013). Robustness of Fama–French three-factor model: Further evidence for India. Vision: The Journal of Business Perspective 17 (2), 119–127.
19. Sharpe, W. F. (1964), "Capital asset prices: A theory of market equilibrium under conditions of risk", The Journal of Finance, 19(3), 425–442. https://onlinelibrary.wiley.com/doi/10.1111/j.1540-6261.1964.tb02865.x
20. Tripathi, V., & Singh, P. (2021). Fama-French five-factor asset pricing model: empirical evidence from Indian stock market. International Journal of Business and Globalisation, 27(1), 70–91. https://ideas.repec.org/a/ids/ijbglo/v27y2021i1p70-91.html
21. Zhang, C. (2025). Dynamic asset pricing: Integrating FinBERT-based sentiment quantification with the Fama–French five-factor model. arXiv. https://doi.org/10.48550/arXiv.2505.01432